Universidad Zaragoza

Academic Year/course: 2022/23

27043 - Algebraic Curves

Syllabus Information

Academic Year: 2022/23
Subject: 27043 - Algebraic Curves
Faculty / School: 100 - Facultad de Ciencias
Degree: 453 - Degree in Mathematics
ECTS: 6.0
Year: 4
Semester: First semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

This is an optative course of the degree in Mathematics. Its main aim is to provide an introduction in two of the most classical subjects in mathematics: algebra and geometry.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (https://www.un.org/sustainabledevelopment/es/), in such a way that the acquisition of the learning outcomes of the module provides training and competence to contribute to some extent to their achievement: (4) Quality education, (5) Gender equality, (8) Decent work and economic growth, (9) Industry, innovation and infrastructure, (10) Reducing inequality, (17) Partnerships for the goals.

1.2. Context and importance of this course in the degree

This subject can be understood as a continuation of the the courses on Linear Algebra, Algebrais Structures and Galois Theory. It is also closely related to the part of the degree in Mathematics devoted to Geometry and Topology.

1.3. Recommendations to take this course

1. To have completed the courses on Linear Algebra, Algebraic Structures and Galois Theory.
2. To attend and participate actively in classes.
3. To keep up assignments and class exercises.
4. Make use of office hours.

2. Learning goals

2.1. Competences

To be able to apply maths knowledge and problem solving skills in a professional context.

To be able to detect what is substantial in a problem, formulate conjectures and either prove or disprove them, to be able to identify false alguments, etc.

To understand and use maths language and methods. To know rigurous proofs if main theorems of different branches of mathematics.

To show proficiency in the previous skills.

2.2. Learning goals

To understand the relationship between notions and methods from algebra and geometry.

To provide local characterizations of geometric objects.

To compute multiplicities and intersection multiplicities.

2.3. Importance of learning goals

They provide complementary skills of an optative character.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

Any student will be guaranteed the right to pass the subject by a final comprehensive exam. Alternatively, the student will be given the possibility to pass the subject by continuous evaluation as follows:

- 50% of the final mark by the resolution of three sets of exercises that will be orally defended.
- 30% from exercise solving in class.
- 20% from a comprehensive written exam. Alternatively, by the elaboration of an individual academic project on a subject related to the course.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

1. Lectures.
2. Problem-solving sessions.
3. Oral presentations.
4. Tutorials.
5. Autonomous work and study.

4.2. Learning tasks

The main lerning tasks will be lectures, problem-solving sessions and oral presentations, tutorials and autonomous work and study.

The teaching activities and assessment tasks will take place in a face-to-face mode, except in the case that, due to the health situation, the dispositions emitted by the competent authorities and by the University of Zaragoza compel to take them to a greater or lesser extent in a telematic form.

4.3. Syllabus

- **Topic 1. Algebraic preliminaires.**
  - Commutative rings and ideals.
  - Rings of fractions.
  - Polynomial rings. Homogeneous polynomials.
  - Noetherian rings. The Hilbert basis theorem
- **Topic 2. Varieties and morhisms.**
  - Affine algebraic sets and ideals of sets of points.
  - Hilbert's nullstellensatz.
  - Polynomial maps, Zariski's topology, morphisms and rational maps.
  - The projective space. Projective algebraic sets.
  - Varieties in a multiprojective space.
- **Topic 3. Algebraic plane curves.**
  - Parameterizable curves.
  - Local properties: singularities, tangents and multiplicities.
  - Multiplicities and local rings.
  - Bézout?s theorem.

4.4. Course planning and calendar

Solving problems classes will be held from the second week after the begining of classes.

Approximate dates for the exercise sets:

- First: end of October.

- Second: end of November.
- Third: end of December.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences website and Moodle.

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=27043